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Phytogeographical notes on the Rocky Mountain Region
VII. Formations in the Subalpine Zone

P. A. RYDBERG

In my Phytogeographical Notes, I have tried to present the distribution of the Rocky Mountain phanerogams viewed from three different standpoints: (1) their zonal distribution, (2) their geographic (provincial) distribution, and (3) their formational distribution. In other words, I have classified the plants: (1) according to the life zone to which they belong; (2) according to their surface distribution, inside as well as outside the Rocky Mountain region; (3) according to the formation to which they belong, i. e., whether they are hydrophytes, or mesophytes, or xerophytes, or any subdivision of these. When I mention formation this should not be taken in a purely ecological sense. In the third paper of the series, "Formations in the Alpine Zone,"* I indicated that I treated the "Formations" purely from a phytogeographical standpoint, and have nowhere treated plant societies, and still two reviewers of my articles (both ecologists) have criticized me for not stating which were the characteristic, the most common, and the secondary species. To do this, when a whole mountain region is treated, is impossible, for in the same class of formations certain species may be the characteristic ones in one locality, while in another they may be only secondary or even lacking altogether.

As shown in the fourth and fifth papers of this series† the vegetation of the Subalpine Zone consists mostly of forests and grasslands. Especially in the Southern Rockies, where the mountain slopes are very steep, another formation is also common, namely, the rock-slides. Where the latter do not exist, the slopes are mostly covered by forest, while the hog-backs and valleys are grasslands.

A. FORESTS

As the forests evidently cover the larger area, they may be treated first. The forest trees are six: *Picea Engelmannii*,

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* Bull. Torrey Club **41**: 459–474. 1914.

† Bull. Torrey Club **42**: 11–18; 629–632. 1915.

Populus tremuloides, *Abies lasiocarpa*, *Pinus aristata*, *Pinus exilis*, and *Pseudotsuga mucronata*, of which the last two really belong to the Montane Zone and extend into the lower part only of the Subalpine Zone. Their relative importance, size, and distribution have been treated before.*

The forest formations of the Subalpine Zone in the Rockies may be divided into more or less defined classes, according to the most characteristic trees found there.

1. SPRUCE-BALSAM FOREST

This formation in the Southern Rockies is mostly found on the northern slopes and along water courses. The predominant tree is the Engelmann spruce, *Picea Engelmannii*. Sometimes it is found in pure stand, sometimes mixed with the subalpine fir or balsam, *Abies lasiocarpa*, occasionally also with the aspen. In the lower part of the zone the red fir, *Pseudotsuga mucronata*, is often added. The following species constitute mainly the flora of the spruce-woods, though several more might be added, especially such as are characteristic of the aspen groves, and occasionally accompany the aspen into the coniferous woods.

The corresponding formation in the Northern Rockies resembles that of the Southern very closely, except that *Abies lasiocarpa* becomes more common on the western side, and on the western slope of the Bitter Root Mountains in places becomes the dominant tree. Lyall's larch, *Larix Lyallii*, and the alpine hemlock, *Hesperopeuce Mertensiana*, are added in the Bitter Root Mountains and the Selkirks, and the former in the main Rockies north of latitude 48° 30′. The red fir, *Pseudotsuga mucronata*, scarcely reaches the subalpine region in the Northern Rockies, but the lodge-pole pine, *Pinus Murrayana*, often enters the lower portion of the zone. As stated in a previous paper, *Picea Engelmannii* and *Abies lasiocarpa* are rare in the Big Horn Mountains, and there often the upper limit of the lodge-pole pine constitutes the timber line.

The undergrowth of the spruce-balsam forest in the Northern Rockies is similar to that of the Southern Rockies. Many of the plants are common to both regions, as seen from the following list. The place of the plants limited to the Southern Rockies is taken by those enumerated below. Species in this and subsequent lists which are marked "†" are limited to the Bitter Root-Selkirk region while those marked "‡" are limited to the Canadian Rockies.

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* Bull. Torrey Club 42: 14–20.

Common to the Southern and Northern Rockies

Trees

Picea Engelmannii
Abies lasiocarpa
(*Populus tremuloides*)
Pseudotsuga mucronata (lower portion of the zone only)

Shrubs

Sorbus scopulina
Lepargyrea canadensis
Pachystima myrsinites
Linnaea americana
Distegia involucrata
Gaultheria humifusa
Vaccinium caespitosum
" *oreophilum*
" *scoparium*

Herbs

Poa crocata
Bromus Richardsonii
Vagnera stellata
Disporum trachycarpum
Lysiella obtusata
Ophrys borealis
" *nephrophylla*
Cytherea bulbosa
Alsine baicalensis
Thalictrum sparsiflorum
Atragene tenuiloba
Parnassia fimbriata
Pectianthia pentandra
Ozomelis stauropetala
Micranthes arguta
Tium alpinum
Atelophragma elegans
Aragallus deflexus
Osmorrhiza obtusa
Ligusticum Porteri
Moneses uniflora
Pyrola chlorantha
" *minor*
" *secunda*
Polemonium delicatum
Pedicularis racemosa
Veronica serpyllifolia
Arnica cordifolia
" *Parryi*
" *pumila*

Restricted to the Southern Rockies

Herbs

Anticlea coloradensis
Limnorchis purpurascens
Aquilegia elegantula
Ozomelis stenopetala
" *Parryi*
Viola neomexicana

Conioselinum scopulorum
“ *coloradense*
Androsace pinetorum
Castilleja confusa
Adoxa moschatellina
Valeriana ovata
Senecio amplectans

Restricted to the Northern Rockies

Shrubs

Ribes laxiflorum
‡ “ *hudsonianum*
“ *petiolare*
Azaliastrum albiflorum
Gaultheria ovatifolia
Chiogenes hispudula
Vaccinium occidentale
“ *globulare*
Linnaea longiflora

Herbs

‡*Alsine borealis*
Aquilegia columbiana
“ *formosa*
Dentaria rupicola
Parnassia palustris
“ *Kotzebuei*
Heuchera glabra
†*Pectianthia Breweri*
‡*Ozomelis trifida*
Atelophragma Forwoodii
Aragallus foliolosus
†*Osmorrhiza Leibergii*
Ligusticum filicinum
Moneses reticulata
Pyrola uliginosa
Aster meritus

2. Pine slopes

The characteristic tree of this formation in the Southern Rockies is the bristle-cone pine, *Pinus aristata*, which occupies dry slopes and ridges especially on the southern side of the mountains. It seldom forms a dense forest. Occasionally *Picea Engelmannii* or *Populus tremuloides* has encroached on the pine slopes and then the woods are more dense. In the lower part of the zone the bristle-cone pine is often mixed with the limber pine, *Pinus flexilis*. As *Pinus aristata* seldom makes a close stand but grows scattered on the slopes, the undergrowth is mostly made up of the grass formations, either that of the mountain slopes or that of the hogbacks. Wherever the trees stand close the undergrowth contains more and more of the element found in the more open woods. Some of the more common species are: *Arenaria Fendleri*, *Arnica cordifolia*, *A. pumila*, *A. Parryi*, *Polemonium delicatum*, *Draba streptocarpa*, *D. aureiformis*, *Pseudocymopterus montanus*, *Solidago* *decumbens*, *Poa crocata*, *Festuca saximontana*, *Agropyron Scribneri*, and *Bromus Richardsonii*.

The general feature of the corresponding formation in the Northern Rockies is the same as that just described, but the principal tree of the Southern Rockies, *Pinus aristata*, is not found there. Its place is taken by *Pinus albicaulis*. This tree grows even more scattered and the undergrowth is composed of plants which are still more characteristic of the grass-covered hogbacks. Some of the plants found in the Southern Rockies, as for instance *Pseudocymopterus montanus*, are lacking. *Calamagrostis purpurascens* and *Agropyron latiglume* are rather common. So are also *Xerophyllum tenax* and *X. Douglasii* in places, especially west of the mountains.

3. ASPEN GROVES

The aspen in the Southern Rockies grows mostly on more gentle slopes than the pines, both on the north and south sides of the mountains, especially where the ground is richer and moist. It often takes possession of the ground after the coniferous forest has been destroyed by fire or otherwise. Usually it grows in groves, but sometimes mixed with the spruce, balsam and pines, especially along the edges of woods.

The aspen is not so common in the Northern Rockies, and this is especially true of the Subalpine Zone. In the Montane Zone it grows usually mixed with other species of *Populus*, birches and alders, while in the Subalpine Zone it is found along the edges of the spruce woods, in company with alders and the mountain ash.

The following plants are characteristic of the aspen groves, or else have followed the aspens where they grow mixed with the other trees:

Common to the Southern and Northern Rockies

Trees

Populus tremuloides

Shrubs

Salix brachycarpa
Sorbus scopulina
Distegia involucrata
Vaccinium scoparium

Herbs

Poa crocata
Bromus Richardsonii

Bromus Pumpellianus
Agropyron violaceum
Carex Geyeri
“ *Rossii*
“ *brunnescens*
Allium brevistylum
Vagnera stellata
Iris missouriensis
Disporum trachycarpum
Coeloglossum bracteatum
Alsine baicalensis
Moehringia macrophylla
Atragene tenuiloba
Anemone globosa
Aquilegia caerulea
Arabis Drummondii
Sieversia arizonica
Lupinus parviflorus
“ *pulcherrimus*
Tium alpinum
Atelophragma elegans
Chamaenerion latifolium
Osmorrhiza obtusa
Pyrola uliginosa
“ *minor*
“ *secunda*
Pedicularis racemosa
“ *bracteata*
“ *Grayi*
Veronica serpyllifolia
Campanula petiolata
Oreochrysum Parryi
Erigeron Coulteri
“ *glabellus*
Anaphalis subalpina
Arnica Parryi
“ *pumila*
Achillea lanulosa
Hieracium gracile
Aster Lindleyanus

Restricted to the Southern Rockies

Shrubs

Salix Wolfii
Ribes coloradense
Ribes Wolfii
Sambucus microbotrys

Herbs

Danthonia Parryi
Anticlea coloradensis
Limnorchis purpurascens
Aquilegia elegantula
Draba chrysantha
“ *streptocarpa*
Viola neomexicana
Ligusticum Porteri
Pseudocymopterus montanus
Pseudocymopterus sylvaticus
Conioselinum scopulorum
“ *coloradense*
Castilleja confusa
Polemonium foliosissimum
Valeriana purpurascens
Antennaria viscidula
Senecio amplectens
“ *ambrosioides*

Restricted to the Northern Rockies

Shrubs

‡*Ribes hudsonianum*
" *petiolare*
Ribes laxiflorum
" *glandulosum*

Herbs

Aquilegia columbiana
" *formosa*
Aragallus foliolosus
Hedysarum sulphurascens
Hedysarum Mackenzii
†*Osmorrhiza Leibergii*
Pedicularis contorta
Aster meritus

4. COPSES AND BORDERS OF WOODS

Shrubberies in the Southern Rockies are not common outside of the willow bogs, and the plants gathered together under this heading do not form a distinct formation but a mixture from several, especially of those of the aspen groves, the willow bogs, and the meadows. It consists in reality of the zone of strife between the last one mentioned and the other two. It is therefore not necessary to give a full list of the plants, but only advisable to mention the more common ones.

Copses are more common in the Northern Rockies, especially along the subalpine brooks, where *Alnus sinuata* is the predominant species.

Common to the Southern and Northern Rockies

Shrubs

Salix brachycarpa
Vaccinium scoparium
Distegia involucrata

Herbs

Phleum alpinum
Calamagrostis canadensis
" *Langsdorfii*
Deschampsia atropurpurea
Elymus glaucus
Panicularia nervata
" *pauciflora*
Poa reflexa
" *leptocoma*
" *Olneyi*
Carex Geyeri
" *Rossii*
" *brunnescens*
Veratrum speciosum
Vagnera stellata
Silene Menziesii
Moehringia macrophylla
Draba nitida

Fragaria bracteata
Castilleja rhexifolia
" *lanata*
Erigeron Coulteri
Antennaria anaphaloides
Arnica Parryi
Anaphalis subalpina

Restricted to the Southern Rockies

Shrubs

Salix Wolfii
Acer trifida (Utah)
Sambucus microbotrys

Herbs

Trisetum montanum
Capnoides brachycarpum
Drymocallis fissa
Lathyrus arizonicus
Ligusticella Eastwoodiae
Pseudocymopterus montanus
Oreochrysum Parryi
Cirsium oreophilum
" *Eatonii* (Utah)
" *griseum*

Restricted to the Northern Rockies

Shrubs

‡*Salix Hookeriana*
‡*Ribes glandulosum*
Ribes hudsonianum
Alnus sinuata

Herbs

Silene repens
" *oregana*
Aquilegia columbiana
Sieversia ciliata
Fragaria bracteata
Lupinus monticola
" *caespitosus*
Astragalus spicatus
Homalobus Bourgovii
Hedysarum sulphurescens
" *Mackenzii*
Chaemaenerion angustifolium
" *latifolium*
Senecio pseudaureus
Castilleja Tweedyi
" *lancifolia*

B. GRASSLANDS

The grasslands have been discussed in the fifth paper of the series,* and the grasses were there enumerated. I shall not repeat here the discussion, but merely list the species of plants which enter into the composition of these different formations.

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* Bull. Torrey Club **42**: 629–634. 1915.

1. MEADOWS

Common to the Southern and Northern Rockies

Muhlenbergia racemosa
“ *comata*
Phleum pratense
“ *alpinum*
Alopecurus aristulatus
“ *occidentalis*
Agrostis asperifolia
“ *hyemalis*
“ *variabilis*
Calamagrostis Langsdorfii
“ *canadensis*
Deschampsia atropurpurea
“ *curtifolia*
“ *caespitosa*
Trisetum subspicatum
“ *majus*
Graphephorum muticum
Danthonia californica
“ *intermedia*
Poa pratensis
“ *reflexa*
“ *leptocoma*
“ *alpina*
“ *Olneyi*
“ *Vaseyana*
Panicularia nervata
“ *pauciflora*
Hordeum jubatum
Carex pyrenaca
“ *nigricans*
“ *eburnea*
“ *Preslii*
“ *brunnescens*
“ *capillaris*
“ *albonigra*
“ *Reynoldsii*
Carex nova
“ *chalciolepis*
“ *atrata*
Veratrum speciosum
Juncus parous
“ *Mertensianus*
Juncoides parviflorum
“ *intermedium*
Lloydia serotina
Bistorta bistortoides
“ *linearifolia*
Alsine strictiflora
“ *borealis*
“ *longifolia*
“ *calycantha*
Silene Douglasii
Anemone globosa
Ranunculus alismaefolius
“ *micropetalus*
“ *eximius*
“ *alpeophilus*
“ *Eschscholtzii*
Aquilegia caerulea
Aconitum columbianum
“ *insigne*
Thlaspi glaucum
Arabis Drummondii
Clementsia rhodantha
Heuchera parviflora
Leptasea Hirculus
Potentilla filipes
“ *diversifolia*
“ *glaucophylla*
“ *decurrens*
“ *arachnoidea*
Fragaria glauca

Dasiphora fruticosa
Sieversia ciliata
Acomastylis turbinata
Viola bellidifolia
Primula angustifolia
“ *Parryi*
Anthopogon elegans
Amarella scopulorum
“ *plebeia*
“ *strictiflora*
Dasystephana Romanzovii
Phlox Kelseyi
Myosotis alpestris
Veronica Wormskioldii
Valeriana edulis
Campanula petiolata
Solidago oreophila
Aster Canbyi
Erigeron elatior
“ *flagellaris*
“ *glabellus*
Erigeron jucundus
“ *salsuginosus*
“ *superbus*
Antennaria bracteosa
“ *corymbosa*
“ *microphylla*
“ *rosea*
Rydbergia grandiflora
Arnica rhizomata
“ *Rydbergii*
Senecio crassulus
“ *perplexans*
“ *atratus*
“ *pseudaureus*
“ *pauciflorus*
“ *cymbalarioides*
Achillea lanulosa
“ *subalpina*
Hieracium gracile
Taraxacum ammophilum
Agoseris aurantiaca

Restricted to the Southern Rockies

Muhlenbergia Wolfii
Agrostis melaleuca
Deschampsia alpicola
Graphephorum Wolfii
Poa callichroa
“ *pudica*
“ *occidentalis*
“ *tricholepis*
Carex bella
“ *epapillosa*
Veratrum tenuipetalum
Silene Hallii
Sophia purpurascens
Cheirinia oblanceolata
Draba streptocarpa
“ *spectabilis*
Potentilla viridior
Aragallus Parryi
Anthopogon barbellatum
Mertensia pratensis
Besseya plantaginea
Castilleja brunnescens
Campanula Parryi
Pyrrocoma Clementis
Aster griseolus
Erigeron formosissimum
Rydbergia Brandegei
Dugaldia Hoopesii

Arnica macilenta
" *subplumosa*
Senecio pudicus
" *chloranthus*
" *lapathifolius*
Senecio anacletus
" *amplectans*
" *foliosus*
" *multicapitatus*
Agoseris graminifolia

Restricted to the Northern Rockies

Agrostis variabilis
Poa nervosa
Carex ablata
" *montanensis*
" *spectabilis*
Juncoides glabratum
Alsine crassifolia
Silene oregana
" *repens*
" *Douglasii*
‡*Pulsatilla occidentalis*
Ranunculus alismellus
" *saxicola*
" *Suksdorfii*
Aconitum ramosum
‡ " *delphinifolium*
Thlaspi californicum
Heuchera flabellifolia
" *ovalifolia*
Potentilla viridescens
" *glomerata*
" *Vreelandii*
" *flabellifolia*
" *virgultata*
Drymocallis pseudorupestris
Acomastylis sericea
Sieversia ciliata
Lupinus monticola
Trifolium Haydeni
Aragallus viscidulus
" *viscidus*
Epilobium latiusculum
† " *Drummondii*
" *oregonense*
" *anagallidifolium*
Dodecatheon uniflorum
Amarella anisosepala
Phlox alyssifolia
Mertensia paniculata
" *stenoloba*
Pentstemon fruticosum
" *crassifolium*
† " *Lyallii*
Castilleja lutea
" *pallescens*
Adenostegia ramosa
Euphrasia mollis
†*Campanula heterodoxa*
Erigeron politus
Antennaria umbrinella
Arnica tenuis
Senecio megocephalus
" *Hookeri*
" *lugens*
‡*Agoseris pumila*

2. DRY VALLEYS AND BENCHLANDS*

Species marked " § " are found in more sandy places; those marked “Utah” are restricted within the region of the Southern Rockies to the Wahsatch and Uintah Mountains of Utah.

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* For description see Bull. Torrey Bot. Club 42: 632. 1915.

Common to the Southern and Northern Rockies

Stipa Tweedyi
“ *minor*
Poa crocata
“ *longiligula*
“ *lucida*
“ *Buckleyana*
Bromus Porteri
“ *Richardsonii*
“ *polyanthos*
Agropyron violaceum
Elymus simplex
Carex Hepburnii
“ *Engelmannii*
“ *occidentalis*
“ *obtusata*
“ *rupestris*
“ *Rossii*
Eriogonum flavum
“ *umbellatum*
Cerastium scopulorum
“ *strictum*
Alsinopsis Nuttallii (Utah)
Anemone globosa
Pulsatilla ludoviciana
Thlaspi californicum
“ *glaucum*
Draba aureiformis
Ivesia Gordonii
Potentilla filipes
“ *arachnoidea*
Dasiphora fruticosa
§*Gayophytum racemosum*
Phacelia heterophylla
Pentstemon procerus
Campanula petiolata
Leptodactylum pungens
Chrysopsis asperella
Macronema discoideum
Townsendia incana
Antennaria aprica
“ *bracteosa*
“ *corymbosa*
“ *microphylla*
“ *rosea*
Hymenopappus cinereus
Senecio Purshianus
Achillea lanulosa

Restricted to the Southern Rockies

Carex Egglestonii
Eriogonum arcuatum
“ *chloranthum*
“ *neglectum*
Cerastium variabile
§*Arenaria confusa*
“ *globosa*
§*Alsinopsis macrantha*
Lesquerella montana
“ *Wardii* (Utah)
Cheirinia lanceolata
Draba Parryi
“ *streptocarpa*
“ *spectabilis*
“ *luteola*
“ *brachystylis*

Geranium Pattersonii
Pseudopteryxia longiloba (Utah)
Pentstemon caespitosus
Chrysopsis alpicola
Geranium pumila
Erigeron flagellaris
Senecio Nelsonii
“ *Jonesii* (Utah)

Restricted to the Northern Rockies

Eriogonum Piperi
“ *polyphyllum*
“ *heracleoides*
Spraguea multiceps
Arenaria lithophila
† “ *salmonensis*
Arabis exilis
Cogswellia montana
Androsace septentrionalis
Phlox alyssifolia
Erigeron Tweedyi
Antennaria albescens
Lygodesmia juncea

3. MOUNTAIN SLOPES*

Common to the Southern and Northern Rockies

Carex pyrenaica
“ *nigricans*
“ *Geyeri*
“ *pseudoscirpoidea*
“ *chimaphila*
Juncus Drummondii
“ *Parryi*
Juncoides spicatum
Lloydia serotina
Salix petrophila
“ *saximontana*
Cerastium scopulorum
“ *strictum*
Anemone globosa
Aquilegia coerulea
Draba nitida
“ *crassifolia*
“ *Parryi*
“ *aureiformis*
“ *aurea*
Arabis oblanceolata
“ *oreophila* (Utah)
Rhodiola integrifolia
Lithophragma bulbifera
Heuchera flavescens
“ *parviflora*
Micranthes arnoglossa
“ *rhomboidea*
“ *brachypus*
Spathularia Vreelandii
Ivesia Gordonii
Potentilla filipes
“ *diversifolia*
“ *glaucophylla*
“ *divisa*
“ *quinquefolia*
“ *nivea*
“ *saximontana*
Sibbaldia procumbens
Acomastylis turbinata
Homalobus humilis
Epilobium clavatum
“ *anagallidifolium*
Angelica Rosei (Utah)

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* For discussion see Bull. Torrey Club 42: 632. 1915.

Amarella scopulorum
" *plebeia*
Dasystephana affinis
Polemonium viscosum (Utah)
Phacelia heterophylla
" *alpina* (Utah)
" *sericea*
" *ciliosa*
Mertensia alpina
Pentstemon procerus
Synthyris pinnatifida (Utah)
" *laciniata* (Utah)
Castilleja occidentalis
Valeriana edulis
Campanula petiolata
Solidago ciliosa
" *oreophila*
Aster andinus
" *frondeus*
" *apricus*
Erigeron glabellus
Antennaria anaphaloides
" *aprica*
" *pulcherrima*
" *umbrinella*
Arnica Parryi
" *pumila*
Senecio Nelsonii
" *crocatus*
" *cymbalarioides*
Artemisia spithamaea
" *scopulorum*
" *saxicola*
Taraxacum scopulorum

Restricted to the Southern Rockies

Carex nubicola
Juncus Hallii
Erythronium parviflorum
Salix pseudolapponicum
Cerastium Earlei
" *variabile*
" *oreophilum*
Vahlbergilla Kingi (Utah)
" *montana*
Anemone zephyra
Aquilegia scopulorum
" *thalictrifolia*
Sophia purpurascens
Cheirinia oblanceolata
Draba chrysantha
" *streptocarpa*
" *spectabilis*
" *luteola*
Rhodiola polygama
Germania debilis (Utah)
Potentilla modesta (Utah)
" *tenerrima*
Trifolium Brandegei
" *Parryi*
Pseudocymopterus Tidestromii (Utah)
Angelica Grayi
Primula angustifolia
Polemonium confertum
" *mellitum*
" *Brandegei*
Leptodactylon Nuttallii
Dasystephana Parryi
Phacelia nervosa
Mertensia lateriflora
" *Bakeri*

Mertensia Parryi
Pentstemon stenosepalus
“ *caespitosus*
Besseya alpina
“ *plantaginea*
“ *Ritteriana*
Castilleja puberula
Pedicularis Parryi
“ *scopulorum*
Valeriana acutiloba
Solidago decumbens
Oreochrysum Parryi
Aster griseolus
Machaeranthera Pattersonii
Senecio fedifolius
“ *petrocallis*
“ *ambrosioides*
Artemisia Pattersonii
“ *Parryi*
Agoseris agrestis

Restricted to the Northern Rockies

Xerophyllum tenax
“ *Douglasii*
Erythronium obtusum
“ *grandiflorum*
Salix Seemannii
“ *cascadensis*
“ *Fernaldii*
Arenaria lithophila
† “ *salmonensis*
Silene Lyallii
“ *multicaulis*
‡*Sophia sophioides*
Draba cana
Arabis Lyallii
Heuchera grossularifolia
“ *flabellifolia*
Micranthes occidentalis
“ *saximontana*
“ *Rydbergii*
Spathularia Brunnoniana
Potentilla Vreelandii
“ *perdisecta*
Drymocallis pseudorupestris
Acomastylis sericea
Sieversia ciliata
Lupinus caespitosus
Trifolium montanense
Cystium platytropis
Viola adunca
Bupleurum americanum
Amarella propinqua
Dasystephana calycosa
“ *monticola*
Phacelia Lyallii
Mertensia paniculata
“ *stenoloba*
“ *Tweedyi*
Pentstemon montanus
“ *pseudohumilis*
“ *Tweedyi*
Pedicularis Hallii
Valeriana septentrionalis
Campanula heterodoxa
Oreostemma Haydeni
Townsendia Parryi
Antennaria lanata
‡*Artemisia arctica*
“ *elatior*
Agoseris pumila

4. Hog-backs*

Common to the Southern and Northern Rockies

Carex Hepburnii
“ *Engelmannii*
“ *occidentalis*
“ *phaenocephala*
“ *obtusata*
“ *rupestris*
“ *Helleri*
“ *Rossii*
Eriogonum arcuatum
“ *flavum*
“ *umbellatum*
Oreobroma pygmaea
Silene acaulis
Cerastium Behringianum
Alsinopsis Nuttallii
“ *obtusiloba*
Anemone parviflora
“ *tetonensis* (Utah)
“ *Drummondii*
Pulsatilla ludoviciana
Smelowskia americana
“ *lineariloba*
Draba ventrosa
“ *oligosperma*
“ *andina*
“ *crassa*
“ *luteola*
“ *aurea*

Rhodiola integrifolia
Ivesia Gordonii
Potentilla divisa
“ *nivea*
“ *uniflora*
“ *saximontana*
“ *arachnoidea*
Sibbaldia procumbens
Dasiphora fruticosa var.
Trifolium nanum
Androsace carinata
Gilia globularis
Phlox depressa
“ *caespitosa*
Eritrichium elongatum
“ *argenteum*
Castilleja occidentalis
Erigeron compositus
“ *melanocephalus*
“ *simplex*
Antennaria aprica
“ *media*
“ *sedoides*
“ *umbrinella*
Chaenactis alpina
Senecio Purshianus
Artemisia scopulorum
“ *spithamaea*

Restricted to the Southern Rockies

Eriogonum chloranthum
“ *neglectum*
Paronychia pulvinata

Arenaria Fendleri
Thlaspi coloradense
“ *purpurascens*

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* For discussion see Bull. Torrey Club 42: 633. 1915.

Lesquerella parvula
“ *Wardii* (Utah)
Cheirinia nivalis
“ *radiata*
“ *amoena*
Draba sobolifera (Utah)
“ *pectinata*
Ivesia utahensis (Utah)
Potentilla tenerrima
“ *minutifolia*
“ *paucijuga* (Utah)
Trifolium stenolobium
“ *bracteolatum*
“ *lividum*
“ *dasyphyllum*
Aragallus Hallii
“ *oreophilus* (Utah)
Oreoxis humilis
“ *Bakeri*
“ *alpina*
Phlox condensata
Synthyris pinnatifida
“ *laciniata*
Chrysopsis alpicola
Erigeron glandulosus
“ *pinnatisectus*
Senecio werneriaefolius
“ *Holmii*
“ *taraxacoides*
“ *Soldanella*

Restricted to the Northern Rockies

Eriogonum Piperi
“ *polyphyllum*
“ *caespitosum*
“ *pyrolaefolium*
Oreobroma minima
Anemone Drummondii
Aquilegia Jonesii
‡*Smelowskia lobata*
† “ *ovalis*
Pilosella Richardsoniana
†*Draba eurocarpa*
“ *densiflora*
“ *lonchocarpa*
Arabis Lyallii
†*Phoenicaulis cheiranthoides*
Coniomitella Williamsii
Heuchera ovalifolia
potentilla brevifolia
“ *Macounii*
“ *wyomingensis*
“ *ovina*
Trifolium scariosum
Aragallus alpicola
“ *viscidus*
“ *viscidulus*
Viola adunca
Pseudocymopterus bipinnatus
Bupleurum purpurascens
Douglasia montana
Phlox costata
“ *diapensioides*
Synthyris dissecta
“ *reniformis*
Townsendia Parryi
“ *florifer*
Oreostemma Haydeni
Erigeron radicatus
“ *Scribneri*
“ *Tweedyi*
Antennaria acuta
“ *mucronata*
“ *pulvinata*
‡*Tonestus laceratus*

C. VARIOUS HYDROPHYTIC FORMATIONS

These consist of bogs, brook banks, lakes, ponds, and brooks. In the Subalpine Zone these contain few grasses and no trees. The bogs may be divided into sedge bogs, willow bogs and *Sphagnum* bogs.

1. SEDGE BOGS

The sedge bogs resemble those of the Alpine Zone. These have already been described in a previous paper.*

Common to the Southern and Northern Rockies

Alopecurus aristulatus
Calamagrostis Langsdorfii
Poa reflexa
Phleum alpinum
Panicularia pauciflora
Carex nigricans
“ *gymnocrates*
“ *disperma*
“ *aurea*
“ *brunnescens*
“ *Reynoldsii*
“ *nova*
“ *bella*
“ *aquatilis*
Scirpus pauciflorus
“ *caespitosus*
Eriophorum angustifolium
“ *gracile*
Juncus balticus montanus
“ *triglumis*
“ *castaneus*
“ *Mertensianus*
Bistorta bistortoides
“ *linearifolia*
“ *vivipara*
Alsine longifolia
“ *strictiflora*
Alsine laeta
“ *crassifolia*
“ *calycantha*
Thalictrum alpinus
Ranunculus affinis
Ranunculus eximius
Trollius albiflorus
Aconitum columbianum
Radicula alpina
Parnassia fimbriata
Micranthes arguta
Geum rivale
Epilobium ovatifolium
“ *Drummondii*
“ *wyomingense*
Hippurus vulgaris
Pyrola uliginosa
Primula Parryi
Anthopogon elegans
Amarella scopulina
“ *strictiflora*
Dasystephana Romanzovii
Pleurogyne fontana
Swertia scopulina
“ *congesta*
Myosotis alpestris
Veronica americana

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* See Bull. Torrey Club **41**: 471, 472, 1914.

Veronica Wormskjoldii
Elephantella groenlandica
Mimulus Langsdorfii
Senecio crassulus
Erigeron salsuginosus

Restricted to the Southern Rockies

Juncus parous
Ranunculus alismaefolius
" *micropetalus*
" *stenolobus*
Caltha rotundifolia
Aconitum Bakeri
" *insigne*
Radicula curvipes
" *Underwoodii*
Epilobium stramineum
Ligusticum Porteri
Senecio atratus
" *lapathifolius*

Restricted to the Northern Rockies

Alopecurus occidentalis
Poa leptocoma
Carex saxatilis
Eriophorum Scheucheri
" *Chamissonis*
‡ " *alpinus*
Tofieldia intermedia
Juncus Regelii
" *nevadensis*
Ranunculus alismellus
" *Suksdorfii*
" *Helleri*
Caltha leptosepala
Aconitum ramosum
‡ " *delphinifolium*
Cardamine umbellata
Cardamine acuminata
Parnassia palustris
" *Kotzebue*
Comarum palustre
Argentina subarctica
‡*Epilobium oregonense*
" *wyomingense*
" *latiusculum*
Pedicularis contorta
" *ctenophora*
" *lunata*
" *Hallii*
" *Canbyi*
" *bracteosa*
" *cystopteridifolia*
Petasites corymbosa

2. WILLOW BOGS

The characteristic vegetation of these consists of shrubby species of *Salix* and *Betula glandulosa*. The herbaceous flora contains most of the plants of the sedge bogs. The shrubs present are the following:

Southern Rockies

Salix Wolfii
" *brachycarpa*
Salix pseudolapponum
" *glaucops*

Salix chlorophylla
Betula glandulosa
Phyllodoce empetriformis
Kalmia microphylla
Distegia involucrata

Northern Rockies

Salix Barkleyi
" *commutata*
" *Tweedyi*
" *pseudomyrsinites*
" *chlorophylla*
Alnus sinuata
Ledum glandulosum
†*Azaliastrum albiflorum*
Phyllodoce glanduliflora
" *empetriformis*
Andromeda polifolia
Vaccinium uliginosum

In the Canadian Rockies quite a number of subarctic willows and other shrubs are added to this flora. These species, which are listed below, grow either in the willow bogs proper or on wet mountain slopes.

Salix Hookeriana
" *myrtillifolia*
" *alaxensis*
" *Barrettiana*
" *Drummondiana*
Salix arbusculoides
" *Seemannii*
" *desertorum*
Ledum groenlandicum
Vaccinium Vitis-Idaea

3. SPHAGNUM BOGS

Sphagnum bogs are exceedingly rare in the Southern Rockies and of very limited extent. The phanerogamic flora, if any, is not different from that of the other bogs. In the northern part of the Northern Rockies, especially in Canada, they are more common. Here, as well as in the northern parts of Montana and Idaho, there are found several phanerogams characteristic of the Hudsonian Zone of the northeast. Among these may be mentioned:

Eriophorum angustifolium
" *Chamissonis*
" *alpinum*
Drosera rotundifolia
" *longifolia*
Thalictrum alpinum
Rubus acaulis
" *arcticus*
" *Chamaemorus*
Oxycoccus palustris
Pinguicula vulgaris

4. Brook banks

Many of the brook banks are lined with willows and *Betula glandulosa* or with sedges. In such cases the flora is practically the same as that of the willow bogs or sedge bogs. In the subalpine regions of the Rockies, we find also another brook bank flora, consisting of herbaceous plants which are neither sedges nor grasses, and which are rarely found in the bogs proper. Brook banks of this type are found mostly where the slope is steep and the valley narrow, so that neither swamps nor grasslands could exist. The characteristic plants of these brook banks are mostly species of *Mertensia*, *Epilobium* and *Juncoides*, and where it is drier we find *Cirsium*.

Common to Southern and Northern Rockies

Poa reflexa
Panicularia nervata
Calamagrostis canadensis
Juncus balticus montanus
Juncoides parviflorum
"   *spicatum*
Delphinium occidentale
Alsine longifolia
"   *borealis*
Epilobium ovatum
Epilobium stramineum
"   *wyomingense*
Mimulus Langsdorfii
Mertensia pratensis
"   *ciliata*
"   *viridula*
Veronica americana
Arnica rhizomata
Senecio triangularis

Restricted to the Southern Rockies

Juncoides subcapitatum
Delphinium Barbeyi
"   *attenuatum*
Oxypolis Fendleri
Castilleja brunnescens
Cirsium Parryi
"   *scopulorum*
"   *oreophilum*

Restricted to the Northern Rockies

Poa leptocoma
Juncoides glabratum
‡*Anemone Richardsonii*
Mertensia paniculata
"   *stenoloba*
Senecio saliens
Chamaenerion latifolium

In the more open places where the taller herbs have not crowded out the smaller ones, the flora consists of the following species:

Common to Southern and Northern Rockies

Poa alpina
Carex bella
" *calciolepis*
" *atrata*
Scirpus pauciflorus
Juncus triglumis
Juncoides spicatum
Alsine baicalensis
" *laeta*
Alsinopsis propinqua
Sagina saginodes
Ranunculus alpeophilus
Ranunculus Eschscholtzii
Saxifraga cernua
" *debilis*
Chrysosplenium tetrandum
Micranthes arnoglossa
Muscaria delicatula
Androsace subumbellata
" *filiformis*
Condrophylla americana
Pleurogyne fontana
Veronica Wormskjoldii

Restricted to the Southern Rockies

Alsine polygonoides
Condrophylla Fremontii

Restricted to the Northern Rockies

‡*Juncoides arcticum*
‡ " *hyperboreum*
‡ " *arcuatum*
Neiocrene parvifolia
Micranthes Lyallii
" *Brunnonianum*
Hemiera ranunculifolia
Epilobium saximontanum
" *anagallidifolium*
" *clavatum*
Romanzoffia sitchensis
" *Leibergii*

5. LAKES, PONDS AND BROOKS

The purely aquatic flora is not well represented in the Subalpine Zone. It contains practically the same species as are in the Alpine Zone with few additions from the Montane Zone.* The following species belong to this formation:

Common to the Southern and Northern Rockies

Sparganum minimum
" *angustifolium*
Potamogeton alpinus
Catabrosa aquatica
Carex aquatilis
Veronica americana
Utricularia vulgaris
" *minor*
Nymphaea polysepala
Hippuris vulgaris
Lemna gibba
" *minor*

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* Compare discussion in Bull. Torrey Club 41: 473, 474; 43: 630.

Restricted to the Northern Rockies

Batrachium confervoides
Veronica scutellata
Lobelia Dortmanna

D. MISCELLANEOUS FORMATIONS

1. ROCK-SLIDES

The rock-slides in the Subalpine Zone* resemble those in the Alpine Zone, and the flora is practically the same with a few additions, as shown by the following lists:

Common to the Southern and Northern Rockies

Selaginella densa
Oxyria digyna
Claytonia megarrhiza
Macronema discoideum

Restricted to the Southern Rockies

Allium Pikeanum
Aquilegia saximontana
Telesonix Jamesii
Heuchera Hallii
Ribes montigenum
Viola biflora
Pseudopteryxia anisata
Primula Parryi
Polemonium Grayanum
" *speciosum*
" *confertum*
" *Brandegei*
Polemonium delicatum
Pentstemon Hallii
" *Harbourii*
" *stenosepalus*
Syntheris plantaginea
Machaeranthera Pattersoni
Senecio Holmei
" *Soldanella*
" *Harbourii*
" *cathamoides*
Senecio invenustus

Restricted to the Northern Rockies

Alsine americana
Telesonix heucheriforme
Ribes parvulum
Pseudopteryxia Hendersonii
Collomia debilis
Polemonium viscosum
Hulsea carnosa
Senecio Fremontii

2. BARE CLIFFS

The flora of the crevices of the bare cliffs is practically the same as that of similar habitats in the alpine region. The species there have already been listed but are again enumerated below.†

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* See Bull. Torrey Club 41: 465. 1914.

† See Bull. Torrey Club 41: 466. 1914.

Common to the Southern and Northern Rockies

Chondrosea Aizoon
Leptasea austromontana
Antiphylla oppositifolia
Oxyria digyna

Restricted to the Southern Rockies

Anticlea coloradensis
Aquilegia saximontana
Polemonium pulcherrimum
Polemonium delicatum
Edwinia macrocalyx (Utah)
Senecio petrocallis

3. TALUS

In many places, under the perpendicular cliffs, there have gathered rather steep slopes of talus. Where this consists of larger rocks, the flora is the same as that of the rock-slides, but where it consists of small fragments and especially where there is a certain moisture, this talus has been taken possession of by certain plants, which can be regarded as forming a distinct formation. The most common of these plants are:

Common to the Southern and Northern Rockies

Carex Geyeri
Juncus Drummondii
" *Parryi*
Alsine laeta
Anemone tetonensis
Epilobium alpinum
" *Hornemannii*

Restricted to the Southern Rockies

Anticlea coloradensis

Restricted to the Northern Rockies

Viola flavovirens

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